

CLAIMS

1.

1 Apparatus for indexing glassware through a series of stations for inspection of the
2 glassware, which includes:
3 first and second circumferential arrays of alternately opposed glassware gripping
4 fingers,
5 first and second carriers respectively mounting said first and second finger arrays for
6 rotation about a common axis,
7 a first rotary electric servo motor coupled to said first carrier for rotating said first
8 carrier about said common axis,
9 a second rotary electric servo motor coupled to said second carrier for rotating said
10 second carrier about said common axis, and
11 control electronics coupled to said first and second motors for timing operation of
12 said first and second servo motors relative to each other.

2.

1 The apparatus set forth in claim 1 wherein said first carrier overlies said second
2 carrier, wherein first motor is coupled to said first carrier by a shaft that extends along said common
3 axis, and wherein said second motor is coupled to said second carrier by a sleeve that surrounds said
4 shaft.

3.

1 The apparatus set forth in claim 1 further including a drive roller at at least one of the
2 inspection stations for engaging an article of glassware at said at least one station and rotating the
3 article about its axis, and a third rotary electric servo motor coupled to said at least one drive roller,
4 said third rotary electric servo motor being coupled to said control electronics for timing operation
5 of said third motor relative to operation of said first and second motors.

4.

1 The apparatus of claim 3 wherein said timing operation of said third motor permits
2 said control electronics to determine the rotational position of an article of glassware as it is rotated
3 and after it is rotated by said drive roller.

5.

1 The apparatus set forth in claim 3 further including a pair of backup rollers disposed
2 at said at least one station in stationary position relative to said carriers, said backup rollers engaging
3 said article of glassware during rotation by said drive roller.

6.

1 The apparatus set forth in claim 5 further including means for adjusting location of
2 said pair of back-up rollers with respect to said carriers.

7.

1 The apparatus set forth in claim 5 further including an actuator coupled to said at least
2 one drive roller for selectively urging said drive roller against an article of glassware at the station,
3 and a sensor coupled to said actuator for indicating absence of an article of glassware at the station
4 as a function of overtravel of said drive roller toward said backup rollers.

8.

1 The apparatus of claim 1 which also includes a lift frame that carries said first and
2 second carriers, said lift frame being adjustable to vary the position of the first and second carriers.

9.

1 The apparatus of claim 8 wherein the lift frame is adjustable to move the first and
2 second carriers relative to an axis of articles of glassware engaged by said gripping fingers as said
3 glassware is indexed through said series of inspection stations.

10.

1 The apparatus of claim 9 wherein said lift frame includes a linear actuator that permits
2 adjustment of the lift frame.

11.

1 The apparatus of claim 9 wherein said linear actuator is driven by a servo controlled
2 motor.

12.

1 The apparatus of claim 8 wherein said first and second rotary electric servo motors
2 are carried by the lift frame.

13.

1 The apparatus of claim 3 which also includes a lift frame that carries said drive roller,
2 said lift frame being adjustable to vary the position of the drive roller relative to said article of
3 glassware.

14.

1 The apparatus of claim 12 wherein the first and second carriers are carried by the lift
2 frame to adjust the position of the first and second carriers relative to and along an axis of an article
3 of glassware to be moved by the carriers.

15

1 The apparatus of claim 1 which also includes a support to position an article of
2 glassware for inspection and wherein said first and second carriers are rotatable in opposed
3 directions to alternately engage and disengage said fingers from an article of glassware, and said
4 fingers are disengaged from said article of glassware when said article of glassware is positioned by
5 said support.

16.

1 The apparatus of claim 15 wherein said support includes a drive roller capable of
2 engaging an article of glassware and rotating the article of glassware.

17.

1 The apparatus of claim 15 wherein said support includes at least one back-up roller
2 for supporting the article of glassware against said drive roller.

18.

1 The apparatus of claim 1 which also includes a first set of support posts, a plurality
2 of pads carried by the first set of support posts to receive articles of glassware on the pads for
3 inspection of the articles, and a second set of support posts on which said first and second carriers
4 are received.

19.

1 The apparatus of claim 18 wherein said first set of support posts is substantially
2 independent of said second set of support posts so that movement of said first and second carriages
3 is isolated from said pads.

20.

1 The apparatus of claim 18 which also includes a lift frame that includes said second
2 set of support posts and is adjustable to vary the position of the first and second carriers relative to
3 the pads.

21.

1 The apparatus of claim 1 which also includes at least one sensor responsive to the
2 position of at least one of the first and second carriers and in communication with the control
3 electronics to permit said control electronics to determine the position of said at least one of the first
4 and second carriers.

22.

1 Apparatus for indexing glassware through a series of inspection stations, which
2 includes:
3 a lift frame disposed on a base and adjustable relative to the base; and

4 at least one carrier carried by the lift frame, adapted to move articles of glassware to
5 and from the inspection stations, and adjustable with the lift frame to vary the position of said carrier
6 relative to the inspection stations.

23.

1 The apparatus of claim 22 wherein said inspection stations are disposed on said base
2 in fixed position relative to said lift frame.

24.

1 The apparatus of claim 22 wherein said lift frame includes an actuator that permits
2 adjustment of the lift frame.

25.

1 The apparatus of claim 24 wherein said actuator is driven by a servo controlled motor.

26

1 The apparatus of claim 22 which also includes a drive roller at at least one of the
2 inspection stations for engaging an article of glassware at said at least one inspection station and
3 rotating the article about its axis, said drive roller being carried by the lift frame and adjustable with
4 the lift frame.

1 The apparatus of claim 22 wherein said lift frame includes a plurality of
2 interconnected support posts on which said at least one carrier is supported and an actuator operably
3 associated with the support posts to move the support posts relative to the base.

28.

1 Apparatus for inspecting articles of glassware at a plurality of inspection stations,
2 which includes:
3 at least one carrier adapted to move articles of glassware through said inspection
4 stations;
5 a drive roller at at least one inspection station for selectively engaging an article of
6 glassware at said at least one inspection station and rotating the article about its axis, the drive roller
7 being moveable toward and away from an article of glassware at said at least one inspection station;
8 and
9 a sensor responsive to movement of the driver roller for indicating absence of an
10 article of glassware at the station as a function of overtravel of said drive roller relative to said at
11 least one inspection station.

29.

1 The apparatus of claim 28 wherein said drive roller is moved by an actuator and said
2 sensor is coupled to said actuator.

30.

1 The apparatus of claim 28 which also includes a flag responsive to movement of the
2 drive roller and disposed in communication with the sensor, said flag moving with respect to the
3 sensor when said drive roller is moved to provide an indication of the position of the drive roller.

31.

1 A method of inspecting containers that comprises the steps of:
2 (a) transporting containers in increments about a central axis through an arcuate
3 array of inspection stations between an in-feed conveyor and an out-feed conveyor, and
4 (b) inspecting the containers at said inspection stations for all physical parameters
5 of the containers that affect commercial acceptability of the containers.